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Special Publication No. 2

ON QUANTITATIVE DISTRIBUTION OF PLANKTON REPRODUCED IN THE NORTHERN PACIFIC

by Zinziro Nakai

October, 1952

Tokyo

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ON QUANTITATIVE DISTRIBUTION OF PLANKTON

REPRODUCED IN THE NORTHERN PACIFIC

P R E F A C E

Along with the recent development of scientific research on fisheries resources in Japan, planktonology is making long strides in its various phases. This tendency seems to be founded on a reason that productivity and distribution of plankton, seasonal as well as geographical, are so much signigicant as to serve as an indicator of abundance and migratory conditions of economic animals in the sea.

In this summary the results brought back from a recent macroplankton investigation in the Northern Pacific will be dealt with in the hope that it may furnish an instance illustrating a whole picture of planktological research undertaken in this country. The present investigation was carried out by the Resources Department of Tokai Regional Fisheries Research Laboratory in an area extending from latitudes 6° to 54° N. for a period May to July 1952 in an attempt at determining amount of the marine life reproduced in that area and so forth.

The detailed information will be reported in some other chances.

METHOD AND MATERIALS

The collection was carried out by two research vessels, "Nissho Maru No. 3" (160 tons), and "Tenyo Maru" (218 tons). The former covered an area between latitudes 6° and 31° N. for a period May 12 to June 14, the latter between latitudes 39° and 54° N. for a period May 10 to June 19, 1952. Minute construction, size and directions for use of the plankton net are omitted here. The net, which is made of bolting silk with approximately 0.3 mm. mesh, was hauled up to the surface, at about one meter per second, from a depth of 150 meters, or if shallower, from the bottom. The collections preserved on board with approximately ten percent of formalin were brought to the laboratory where, after sorting, the number of individuals has been counted and the wet weight of specific groups from every haul determined. The data used here are made available from the collections at the stations which have been chosen for this paper in such a way that they fall on a strait line as much as possible.

R E S U L T S

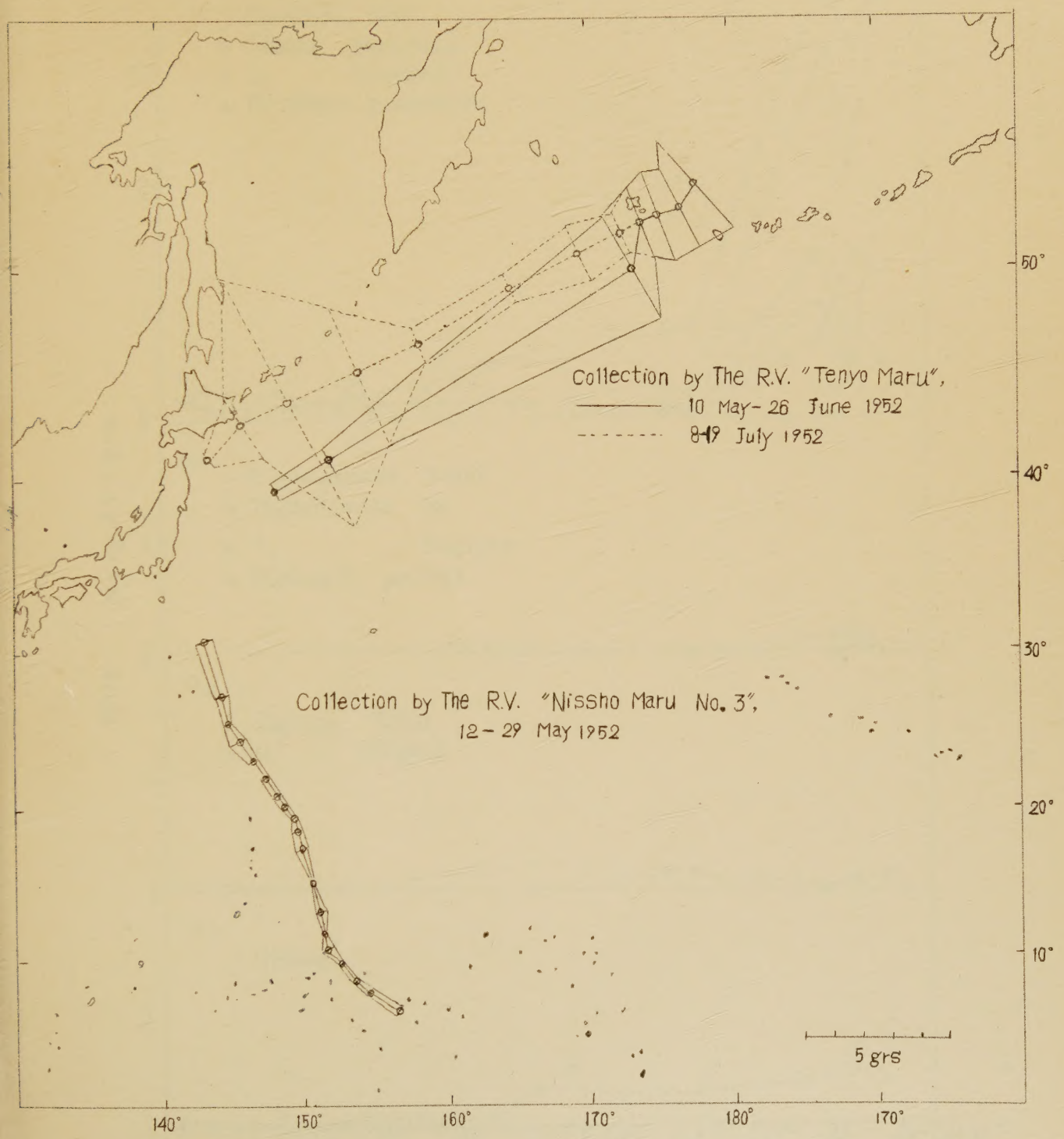
1. Quantitative Distribution. - Horizontal distribution of plankton in total wet weight is indicated on Fig. 1; latitudinal distribution of Calanus plumchrus, C. cristatus and total copepods on Fig 2-a; total Euphausiidae, Thysanoessa longipes, T. sp. and Euphausia pacifica on Fig. 2-b; total Sagitta and S. elegans on Fig. 2-c; and other miscellaneous plankton on Fig. 2-d.

Table 1 shows minimum and maximum values of important species in number of individuals and wet weight per haul. The area is separated into two parts, south and north, nearly along latitude 35° N.

2. Specific Occurrence - Species which occurred heavily more than others in the waters are tabulated by area and in order of wet weight as follows;

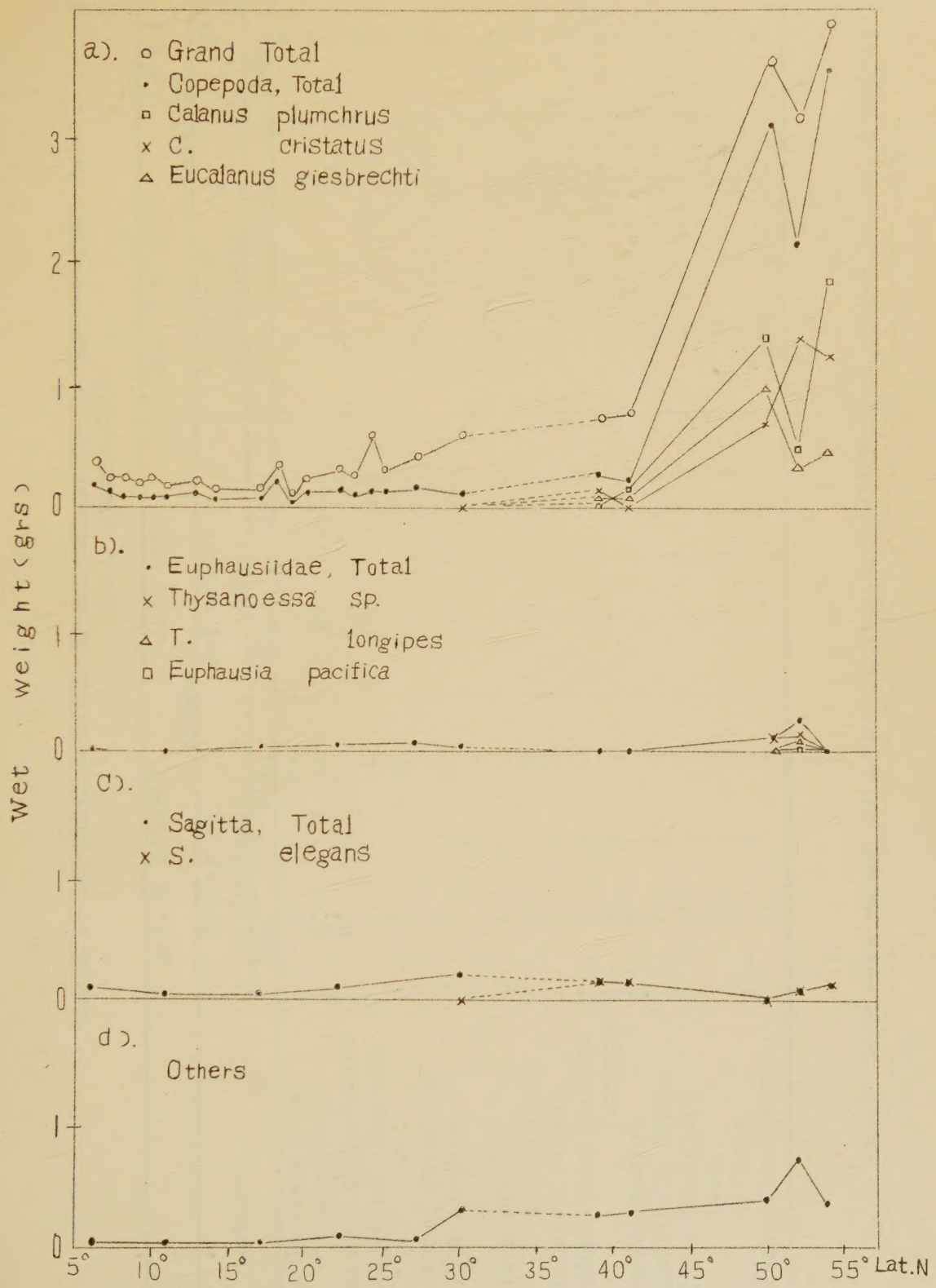
FIGURE 1 QUANTITATIVE DISTRIBUTION OF MACROPLANKTON IN THE NORTHERN PACIFIC

May to July 1952



Note : Data show plankton in wet weight per haul by a net (45 cm. in diameter)

FIGURE 2 SPECIFIC AND QUANTITATIVE DISTRIBUTION OF MACROPLANKTON IN THE NORTHERN PACIFIC, May to July 1952



Note: Data show wet weight of each species per haul by a net (45 cm. in diameter.)

TABLE 1 DOMINANT SPECIES OF MACROPLANKTON IN THE NORTHERN PACIFIC
Early Summer 1952

Species	Lat. N 39°-54° 12-29 May 9 Stations				Lat. N 6°-31° 10 May-22 June 6 Stations			
	Number of Individuals		Wet Weight (mgr.)		Number of Individuals		Wet Weight (mgr.)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Calanus cristatus	0	224	0	2,070	0	0	0	0
C. plumchrus	80	1,661	35	1,842	0	0	0	0
Encalanus giesbrechti	48	288	69	995	0	0	0	0
Thysanoessa longipes	0	4	0	164	0	0	0	0
T. sp.	0	32	0	175	0	0	0	0
Euphausia pacifica	0	2	0	53	0	0	0	0
Sagitta elegans	0	48	0	209	0	0	0	0
Calanus minor	0	0	0	0	0	112	0	24
C. tenuicornis	0	0	0	0	0	56	0	40
Mecynocera clausi	0	0	0	0	0	132	0	16
Clausocalanus pergens	0	0	0	0	0	16	0	4
C. furcatus	0	0	0	0	0	120	0	16
Euchaeta marina	0	0	0	0	0	24	0	32
Scolecithrix danae	0	0	0	0	0	36	0	16
Sagitta hexaptera	0	0	0	0	0	8	0	105
S. lyra	0	0	0	0	0	2	0	20
S. enflata	0	0	0	0	0	22	0	70
Pterosagitta draco	0	0	0	0	0	14	0	35

Note: Data show amount of macroplankton by species by a net(45 cm. in diameter)

Southern Area (Lat. 6°-31° N.)	Northern Area (Lat. 39°-54° N.)
Sagitta hexaptera D'Orbigny	Calanus cristatus Kröyer
Doliolum denticulatum Quoy et Gaimard	C. plumchrus Marukawa
Sagitta spp.	Eucalanus giesbrechti Mori
Euphausia spp.	Sagitta elegans Verrill
Calanus minor (Claus)	Thysanoessa sp.
C. tenuicornis Dana	T. longipes Brandt
Euchaeta marina (Prestandrea)	Themisto sp.
Sagitta enflata Grassi	Euphausia pacifica Hansen
Phyllosoma	Calanus finmarchicus (Gunner)
Hydromedusa	Euchirella rostrata Claus
Sagitta lyra Krohn	----------
Pterosagitta draco (Krohn)	Aglantha digitale Haeckel
Scolecithrix danae (Lubbock)	Limacina helicina (Phipps)
Clausocalanus pergens Farran	Clio sp.
Tomopteris sp.	Pseudocalanus elongatus Boeck
Mecynocera clausi (Thompson)	Metridia lucens Boeck
Amphipoda	Tomopteris sp.
Calanus darwinii (Lubbock)	Eggs and larvae of Atka mackerel
Clausocalanus furcatus (Brady)	and Alaska pollack
Eucalanus mucronatus (Giesbrecht)	
Ostracoda	
Euchaeta longicornis (Giesbrecht)	

Clausocalanus arcuicornis (Dana)	
Paracalanus aculeatus Giesbrecht	
Pleuromamma spp., Eucalanus spp.,	
Corycaeus spp., Oncaea spp., Acartia sp.	

Note: Species under the dotted line are listed regardless order of the amount.

3. Consideration and Conclusion. - Quantity of macroplankton distributed over the northern area has been found by far greater than that in the south. Take the weight of the collections in May and June for instance. It is nearly ten times as great as amount of the collections in the southern area, a fact which reveals an enormous productivity of the marine life existing there.

This is supposed to be a reason that the stocks of tuna and skipjack which are born in lower latitudinal areas are maintained by their feeding migration to the north (see Figs. 1, 2 and Table 1).

According to an accepted theory, amount of plankton reproduced in a cold-water region is said to be greater than that in a warm-water region. The present investigation has proved that the planktonic situations in the Northern Pacific form no exception to the rule. It may be needless to say that this fact is attributed to difference of chemico physical characters of the seas, that is, different vertical stabilities which varied amount of nutrient salts supplied from a deeper layer to an upper layer.

In case of macroplankton none of the species occurred during this season were found common to the both areas. For this reason it also became evident that each species is a perfect indicator of, either a warm water mass, or cold water mass, in the ocean (see Fig. 2, Table 1, and Table on Page 2).

Of the total weight of macroplankton, a greater portion is represented by copepods distributed in the two areas, and particularly in the north where both Calanus cristatus and C. plumchrus are the most dominants among others (Fig. 2). They were found in plenty in the stomach contents of salmon caught by the research vessel on the same occasion. The fact is certainly a manifest that they are important productive source of the fish in the waters adjacent to the Aleutian Islands.

This information is nothing but an example obtained from the recent expedition. However, scientific research on productivity of plankton such as this is expected to make a considerable advance here in Japan for the purpose of management and utilization of fisheries resources.

N O T E

This paper has been prepared by the request from Fisheries Agency for submitting an information before the Fourth Indo-Pacific Fisheries Conference to be held in Manila in October 1952, in which Dr. M. Fujinaga, chief of Research and Investigation Department, Fisheries Agency, and Dr. K. Kuronuma, director of Fresh Water Fisheries Research Laboratory, are scheduled to represent the Japanese Government. For this reason the purport of the paper has been directed to introducing a trend of planktology in Japan to the participants from other countries, taking this for instance. A scientific report on the research cited here in part is expected to be made public in other opportunities together with the remaining data and research information in detail.

Acknowledgment is expressed for cooperation offered in the investigation to the officials of First Pelagic Fisheries Section and Second Pelagic Fisheries Section, Fisheries Agency, Fisheries Inspectors, and Nankai Regional Fisheries Research Laboratory; to field investigators and crews of "Tenyo Maru" and "Nissho Maru No. 3" for collecting samples; to Mr. K. Honjo and Mr. T. Kashima who helped the author through laboratory treatment of the materials; to Mr. M. Ishida and Mr. S. Hayashi who also rendered assistance in preparation of this information.

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